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"AIR TRANSPORT."

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I purpose in this paper to deal with the development in air transport which has taken place since civil aviation between England and the Continent first started at the end of August, 1919. A great deal of attention has been paid in the press to air services of the future, to the detriment of the consideration of results obtained up to the present. I propose to deal mainly with the actual results which have been achieved.

In 1919, transport by air commenced with a transport vehicle tried out only under war conditions, where performance rather than economy was the dominating feature. The personnel had all been trained under war conditions, and it was by no means certain that, apart from the service paying its way, such a service would be at all possible under the weather conditions prevailing in this part of the world. The results have, however, shown that, apart from the question of flying in fog or flying when there is practically no visibility, there are no meteorological conditions preventing a regular and reliable service.

I will deal with the subject under the following heads :—

(1) The character of the loads.
(2) The routes operated.
(3) The results in passengers carried and efficiency of the service.
(4) The costs of the service.
(5) The question of subsidies.
(6) Probable future developments.

(1) *Character of the loads.*

It would appear that where there are two centres of large population and industrial development, with facilities for transportation between the two, the amount of correspondence and the number of travellers passing between them increase in like proportion. The call for quick delivery of parcels and freight does not seem to increase in anything like the same proportion, largely, perhaps, due to the time that is taken for the distribution on the ground. In air transport, therefore, most attention has been paid to and most success obtained by the carriage of passengers and mail rather than freight. It would be interesting to know if the results are the same for high speed rail and boat traffic.

Probably, if distance increases, there will be a greater demand for transport of samples and other packages by air. Another difficulty arising out of freight transported by air, is the Customs clearance delay, so that, combined with the time taken for delivery, there may be little gained over the ordinary boat or train.

(2) *The routes operated.*

There are, at the present time, three routes in operation by British companies, London—Paris, by Handley-Page Transport, Ltd.; London—Brussels—Cologne, by Instone Air Line, Ltd., and Manchester—London—Amsterdam, by Daimler Hire, Ltd.

French—The following are the main air lines :—

SOUTH.—Toulouse—Barcelona, through Spain to Casablanca, by the Latecoere Co.

NORTH and SOUTH.—Paris—Brussels—Amsterdam by the Compagnie des Messageries Aeriennes.
London—Paris—Marseilles, by the Compagnie des Messageries Aeriennes.
Paris—Lausanne, by the Compagnie des Grand Express Aeriens.

EAST.—Paris—Strassburg—Prague—Warsaw, by the Compagnie Franco—Roumaine de Navigation Aerienne.
Paris—Strassburg—Prague—Budapest—Constantinople, by the Compagnie Franco—Roumaine de Navigation Aerienne.

Of these, the route to Marseilles has only just been opened and is, as yet, not fully organised.

The route to the east has been in operation since 1920, but is not operated during the winter months, the period of operation being from March 15th to November 15th. The third route from Toulouse occupies two days and covers a distance of 1,850 kilometres—say 1,150 miles.

The first day's journey is from Toulouse to Alicante *via* Barcelona, the departure being 9 o'clock in the morning, the destination being reached at 3.15 in the afternoon; the next day the departure is made at 8 o'clock from Alicante, and the arrival at Casablanca is at 3.45 in the afternoon.

Figure A gives the map of these routes. It is interesting to observe on this map how Europe is cut up from an air point of view by the Alps and the eastern extensions. The crossing of these mountain ranges must present great difficulties from the air point of view for very many years to come.

(3) *The results in passengers carried and efficiency of the service.*

I have taken as an example the London—Paris route, as more attention has been given to this than the two other routes, and it, therefore, serves as an illustration of the way in which the traffic has developed. Table I.

FIG. A.

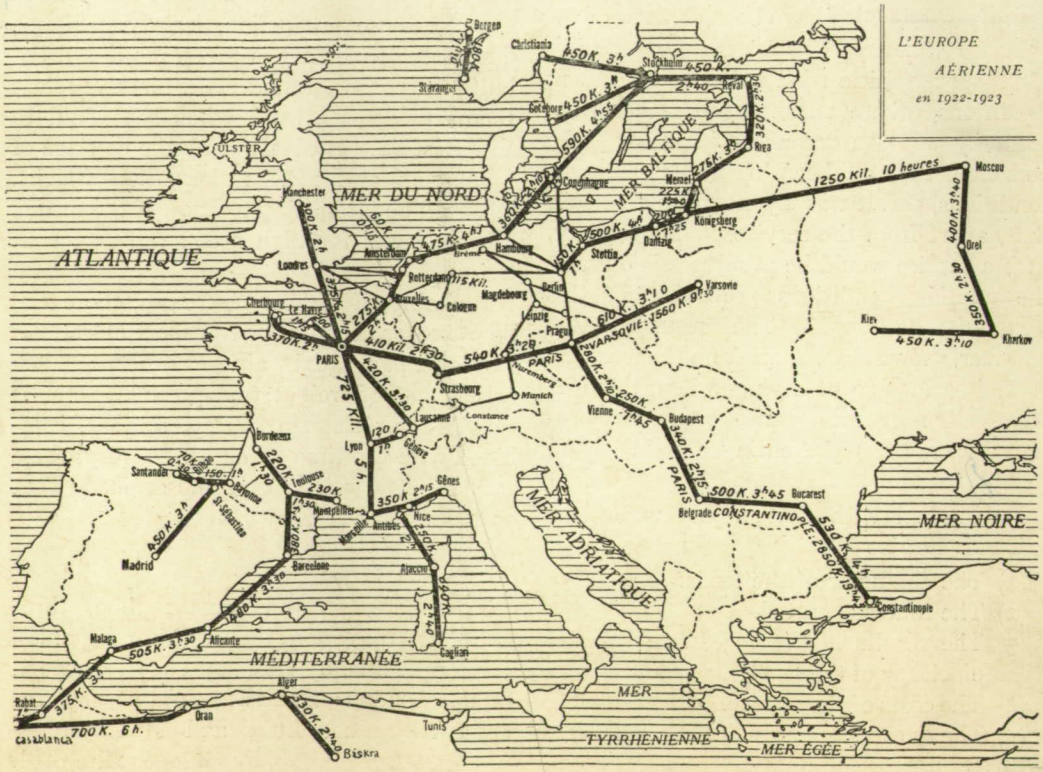

TABLE 1.

MONTHLY RECORD OF PASSENGER TRAFFIC CARRIED BY FRENCH AND BRITISH AIRCRAFT ON LONDON—PARIS AIR ROUTE.

	1920.			1921.			1922.		
	British.	French.	Total.	British.	French.	Total.	British.	French.	Total.
January ...	—	—	—	33	23	56	113	39	152
February ...	—	—	—	45	45	90	183	85	268
March	135	—	135	86	269	355	380	178	558
April	206	18	224	408	338	746	577	174	751
May	435	106	541	559	470	1,029	808	259	1,067
June	591	75	666	686	746	1,432	769	174	943
July	792	73	865	841	766	1,607	1,011	261	1,272
August	775	50	825	920	817	1,737	1,722	322	2,044
September ...	643	35	678	592	362	954	1,053	329	1,382
October... ...	585	49	634	560	279	839	519	351	870
November ...	281	48	329	274	118	392	206	73	279
December ...	88	26	114	176	60	236	186	75	261

shows the number of passengers carried per month for the three years 1920, 1921 and 1922.

Several features emerge from a comparison of the figures. The first is the great similarity between the passenger distribution for the different months in any given year. The high peak attained in July and August of each year indicates either that the service is largely composed of tourists, or that weather conditions or the longer days of summer permit of flying and, therefore, more services to be run. All of these causes, no doubt, operate to produce the effect shown. Very noteworthy are the low figures of passengers carried in the four months November, December, January and February, a result largely due to the number of days on which flying is prevented owing to fog and bad visibility. The increase in traffic in succeeding years is negligible for these months compared with the big increases in the summer months. This disparity between traffic in winter and summer working must be evened up if air transport is to be an economic proposition. It would be interesting to have a comparison of the seasonal variations of passenger traffic in other forms of transport.

The results for 1922 are particularly interesting. For this year, three British companies were in competition, and two French, and a great deal of publicity was given to the services. This competition started from April 1st. Prior to that, the curve shows that there was an increase in passenger traffic over 1921, a year of exceptionally fine weather. In April, a collision in the air occurred in France, a machine operated by the Daimler Hire, Ltd., colliding with one belonging to the Compagnie des Grand Express Aeriens, and, in consequence, the adverse effect is shown in the April figures, which drop below those of 1921. The good results of the next few weeks' working helped to make this accident forgotten, so that, in May, the figures for 1921 and 1922 are approximately equal. In June, a Spad belonging to the Compagnie des Grand Express Aeriens fell into the sea off Folkestone, the pilot and three passengers being killed. The effect of this accident is again shown in the June and July figures, these falling below those of 1921. An examination of the weather figures for 1922 for these months does not afford any meteorological explanation for the fall in passengers. In August, September and October, the adverse effect of the accidents is no longer felt and the numbers increase. These figures are interesting as showing the effect of (a) fog and bad weather conditions, and (b) accidents, upon the resulting traffic. More important than all, it is interesting to see the way in which the traffic has grown.

I have given the number of passengers who in these years travelled by British machines, and the figures for both the total passengers, as well as the British passengers, are given in Tables 1 and 2 for the three years. In 1920, 80 per cent. of the passengers went by British machines. In 1921, the number of British machines was restricted owing to the subsidy conditions

TABLE 2.

MONTHLY RECORD OF FLIGHTS CARRIED OUT ON LONDON—PARIS ROUTE BY BRITISH AND FRENCH AIRCRAFT.

	1920.			1921.			1922.		
	British.	French.	Total.	British.	French.	Total.	British.	French.	Total.
January ...	77	8	85	15	48	63	44	37	81
February ...	82	13	95	25	48	73	81	71	152
March	128	48	176	34	102	136	112	100	212
April	130	54	184	58	104	162	202	116	318
May	237	86	323	76	161	237	309	172	481
June	360	74	434	112	211	323	257	152	409
July	415	62	477	159	193	352	266	171	437
August	448	66	514	155	222	377	365	217	582
September ...	407	66	473	111	167	278	220	188	408
October... ...	374	83	457	106	148	254	54	159	213
November ...	155	62	217	74	110	184	28	58	86
December ...	41	35	76	68	51	119	—	—	—

and the percentage fell to 50. In 1922, with an adequate number of British machines on the route, the percentage again rose to 75—80 per cent. It is a matter for gratification to us in this country that this preference is accorded to British machines.

It might be claimed that this preference is due to the nationality of the passengers, for practically all the passengers are either English or American and, as such, might prefer to travel by a company with an English-speaking personnel. No doubt this has some influence on the traffic, but the greater regularity and reliability of the English services is without doubt the primary cause.

TABLE 3.

EFFICIENCY* OF BRITISH AIR SERVICES ON THE LONDON—PARIS AIR ROUTE.

	1920.	1921.	1922.
January	42.1	58.3	65.9
February ...	68	76	92.9
March	71.4	95.4	—
April	76.7	94.8	93.9
May	78.6	94.7	92.3
June	85.3	91	92.3
July	75.3	93.8	95.2
August	89.4	94.8	95.2
September ...	86	93	95.4
October	87.3	92.9	89.5
November... ...	78.5	71	84.6
December ...	61.8	71.6	—

* Per cent. to total flights commenced of flights completed in less than four hours.

The figures for the regularity of the service shown in the Table 3 show a great improvement in this respect in 1922 compared with 1920.

I have heard it stated by some writers for the press that the subsidized services merely provide pleasure trips for joy-riders, and that the nationality of the passengers travelling, and the seasonal variation referred to above, prove that the greater proportion of the traffic is tourist. The argument deduced is that the country's money is wasted in subsidies merely to provide such pleasure trips. There is, however, another side to the argument. If it is a national necessity to have a reserve of machines in the air and pilots and mechanics in training, the cost to this country of such service is diminished by the amount of the contribution made by such passengers, and the greater the number of passengers from abroad who patronise and pay for the service, the greater the proportion of the contribution paid for from abroad.

The figures given above relate to the London—Paris air service and have been taken as typical; more passengers travel on this route than on any other.

The results from these French lines are given in Tables 4, 5, 6, 7 and 8 and are exceedingly interesting, especially on the Casablanca route. Here there is a clear indication of the gradual patronage by the public for postal purposes of the service when the saving of time becomes appreciated by the public.

TABLE 4.

TRAFFIC UPON THE PARIS, BRUSSELS, AMSTERDAM AIR ROUTE IN FRENCH, BELGIAN OR DUTCH AIRCRAFT.

	Flights made.	Kilometres flown.	Passengers carried.	Freight in kg.	Mail ~~Post~~ in kg.
1919 ...	497	101,789	193	4,217	214
1920 ...	388	110,245	371	1,739	225
1921 ...	814	310,710	2,010	20,522	566
1922 ... (up to 31st Oct., 1922)	503	138,615	1,224	38,183	474

(4) *The costs of the service.*

Air transport, to be successful, must not be too expensive, although, owing to its high speed, a higher price can be obtained than for slower means of transportation. The largest portion of the cost, when the service is small, is the overhead expense and general establishment charges, which cannot be reduced below a certain amount. These reach a high figure per passenger when the service is small. The capital of the transport company is mostly invested in machines, engines and spare parts necessary for the carrying on of the service, and it is essential, if the cost per passenger is to be kept down, that the equipment should be used the maximum amount possible. Aircraft in operation, as regards the aeroplane itself, cost little to keep up, and have quite a long life; it is the motor that is the most expensive part to run. In determining the actual cost of running, it is, therefore, an obsolescence rather than a depreciation charge for the aircraft that has to be included, the amount to be written off per annum depending on the rate of technical progress in aircraft.

It is obvious that the aircraft should be kept flying continuously in the service with no time on the ground beyond that necessary for inspection, adjustment or overhaul, and that there should be a sufficient supply of engines always available for change when they require overhaul or when a fault develops. There are limits, however, imposed upon such system of operation, owing to night flying being as yet impossible commercially, and owing to the restricted hours of flying in winter time caused by the shorter flying hours, also by bad weather such as fog, etc. As the services expand so will the overhead charge per passenger or pound freight decrease, and therefore great improvement is to be expected along these lines.

The actual costs at the present day vary considerably, and are dependent on whether the aircraft are used in an extensive manner, or whether a large fleet is used with a large number of machines in reserve but not used. The cost, for instance, of the twin engine machines used on the London—Paris service is approximately 6s. per mile flown, and the single engine machines about 4s. 6d. This corresponds to a cost per ton mile, calculated on the full load capacity of the machine, of 3s. 6d. for a twin engine machine and 4s. 6d. to 5s. for the single engine machine of a similar capacity. The cost of petrol and oil in the twin engine machine is approximately £4 per hour. With an average flying speed of 85 miles per hour, this corresponds to 1s. per mile, or, say, 7½d. per ton mile. It is evident, therefore, that between this figure and 3s. 6d. there is an ample margin for economy and improvement. These figures show that the actual cost of running to-day does not depend so much upon the economy of the actual machine used and petrol, oil, etc., or even on the question of upkeep. The cost of air transport to-day is mainly due to the minimum cost of the general charges that have to be maintained if a service of any description is run. For an increase in the size of the service by two or three times, there will be nothing like a corresponding increase in the running cost.

(5) *The question of subsidies.*

Subsidies have never been favourably looked upon in this country. If public money is spent in subsidizing an industry, there must always be a certain amount of State control, and wherever there is State

TABLE 5.

Compagnie Franco-Roumaine de Navigation Aerienne.

TRAFFIC UPON THE PARIS, STRASBOURG, PRAGUE, WARSAW, BUCHAREST, CONSTANTINOPLE AIR ROUTE IN FRENCH AIRCRAFT.

1920 (*Paris, Strasbourg, Prague*).

Month.	Kilom. flown.	Passengers.	Freight. kg	Mail Post. kg
September	4,210	1	1,900	4,301
October	33,733	13	187,385	33,173
November	18,783	1	303,245	24,156
December	2,526	—	14,685	3,145
Total for 1920	59,252	15	507,215	64,775

1921 (*Paris, Strasbourg, Prague, Warsaw*).

Month.	Kilom. flown.	Passengers.	Freight. kg	Mail Post. kg
January	10,163	—	5,650	7,516
February	16,339	4	26,650	7,393
March	40,693	55	167,475	24,154
April	51,128	72	951,725	81,449
May	65,233	134	5,170,073	113,425
June	69,909	188	4,692,845	149,915
July	71,983	205	3,262,413	195,842
August	89,938	276	3,972,784	227,791
September	92,855	199	6,231,605	314,413
October	82,708	166	5,453,700	312,590
November	15,565	29	977,220	16,066
Total for 1921	606,514	1,328	31,912,140	1,450,554
Preceding year	59,252	15	507,215	64,775
Total to end of 1921 ...	665,766	1,343	32,419,355	1,515,329

1922 (*Paris, Constantinople and Paris, Warsaw*).

Month.	Kilom. flown.	Passengers.	Freight. kg	Mail Post. kg
February	11,645	10	132,300	15,600
March	43,106	22	1,335,000	134,000
April	70,630	40	2,240,000	134,000
May	122,397	135	3,298,000	248,000
June	140,603	158	8,170,000	338,000
July	118,304	157	4,830,000	314,000
August	135,799	170	3,970,000	408,000
September	128,608	99	5,060,000	382,000
October	94,646	34	3,814,000	250,000
November	33,234	8	1,068,000	100,000
Total for 1922	898,972	933	33,917,300	2,323,600
Preceding years	665,766	1,343	32,419,355	1,515,329
Total to end of 1922 ...	1,564,738	2,176	56,336,655	3,838,929

TABLE 6.

Compagnie Franco—Roumaine de Navigation Aerienne.
SCHEDULE OF FLIGHTS ON PARIS, STRASBOURG, PRAGUE, WARSAW, CONSTANTINOPLE AIR ROUTE.—1922.

	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
Flights scheduled	84	186	180	240	300	310	310	311	346
Flights completed	20	77	113	216	262	239	257	206	157
Bad weather interruptions of Service—									
Scheduled flights not started ...	58	88	60	10	19	46	26	77	155
Flights started but not continued ...	1	8	—	—	—	—	—	—	—
Flights completed with interruptions	1	5	5	2	3	5	3	7	23
Total	60	101	65	12	22	51	29	84	178
Interruption of Service due to engine trouble—									
Flights not started	—	1	—	2	6	5	8	6	4
Flights started but not continued ...	—	2	—	1	3	2	1	3	1
Flights interrupted owing to engine trouble	4	5	2	9	7	11	15	12	6
Total	4	8	2	12	16	18	24	21	11

TABLE 7.

NUMBER OF LETTERS CARRIED PER MONTH BY THE LATECOERE AIR LINE ON THE AIR ROUTE TOULOUSE—CASABLANCA (ALGIERS).

	1920.	1921.	1922.
January	4,562	16,377	50,851
February ...	5,717	12,025	52,699
March	7,147	14,005	75,909
April	8,381	17,179	80,556
May	12,828	18,878	93,837
June	12,897	22,788	119,258
July	17,758	28,107	124,977
August	22,582	34,283	128,562
September ...	24,373	35,036	141,532
October	24,347	40,601	172,313
November... ...	23,098	41,340	161,778
December ...	17,969	47,245	——

interference in commerce, results are bad for both sides, as has been only too clearly shown during and since the war.

There are three main reasons why subsidies have been and are being given by a great many European countries for commercial aviation. They are as follows: Firstly—a political consideration. If a country subsidizes an international line, the aeronautical outlook of the countries through which that line passes tends towards the same point of view as that of the country subsidizing the service. This might be considered as a political penetration to obtain a control in aeronautical policy.

There is a possibility, too, of orders resulting for the aircraft industry of the country giving the subsidy. The latter is not, however, a valid reason for the subsidy being given. If the organization and running of such an international air line will benefit the aeronautical industry with orders, then it is for the industry to subsidize the line to obtain the business.

The second reason is a military one. Even in a country where there is conscription, the provision of a large enough number of pilots and mechanics by military training only is a matter of difficulty. By maintaining a large number of machines in the air on commercial air services, with a corresponding number of pilots and mechanics, etc., there is available in time of war a reserve for national emergencies. Whether this is a better means than, say, a territorial air force is a matter for the service experts to determine, and also is dependent upon the relative cost to the State of the two methods. On the face of it, it would appear to the layman that it would be cheaper to maintain reserves on the civil aviation basis, as a large proportion of the cost is contributed by the public in the shape of the air transport companies' receipts.

A further and more important point is

TABLE 8.

TRAFFIC ON THE TOULOUSE, CASABLANCA AIR ROUTE BY THE LATECOERE AIR LINE.

	Flights made.	Kilometres flown.	Passengers carried.	Freight in kg.	Mail ~~Post~~ in kg.
1919 ...	250	107,470	41	678	178
1920 ...	923	366,049	223	9,948	3,417
1921 ...	1,900	692,415	455	25,555	6,707
1922 ...	2,270	840,406	739	33,560	24,995

that, unless the public in a country is educated to air travel and the use of aircraft, it is impossible to develop fully an air sense. Military supremacy in the air will not, unless civil aviation is encouraged, come to any nation in the way that supremacy on the sea has come to the British Empire as a result of the great mercantile marine development that there has been always in the Empire.

The third reason for the giving of subsidies is a commercial one. Improvement of communication develops the resources of a country. It is especially necessary within the British Empire where such large distances have to be traversed. At the commencement, the cost of organisation of air communication owing to overhead charges, etc., is high, and it is to help the initial lean years that a subsidy is necessary. Eventually, however, from a commercial point of view the subsidies must cease and the whole policy underlying their grant must be to make the services ultimately self-supporting.

The way in which subsidies should be paid has been a subject of discussion in many countries. From the military point of view, as machines have to be kept in the air and pilots and mechanics kept in training, the basis of a lump sum payment per annum for a minimum number of miles flown and pilots and mechanics kept in training, seems to be the fairest one that is possible to both sides.

From a commercial point of view, unless the service results in a minimum amount of traffic, it has no ultimate value to the State. Therefore, it would appear that here again a lump sum payment for a minimum amount of passenger traffic or freight obtained during the year would be the most equitable basis. Better still it would be if, in addition to the lump sum payment for the minimum traffic, there were a subsidy increasing in amount the results obtained; so that there was a direct incentive to the further development of the line.

In Great Britain at the present time, the subsidy is based on the lump sum payment for a minimum number of flights made and machines, pilots and mechanics kept in training. The basic reason for the subsidy in Great Britain, therefore, seems to be military.

Attached hereto are the subsidy conditions for three of the French companies, with examples of the sums paid per trip. A comparison between the English and French subsidy amounts is as striking as the discrepancy between the results achieved. It would appear that some intermediate subsidy arrangement between the two extremes which we have in the two countries, would lead to the most favourable development of aviation.

(6) *Probable future developments.*

The development of civil aviation in the future from the point of view of the British Empire has been most ably dealt with in the report of the Air Ministry for the half-year ended September 30th, 1921, in Appendix III, where the value to the Empire of air services, and the services rendered by them, is dealt with very fully. I do not propose to go over this ground which has been so often covered.

I have referred in the costs to the figures which obtain to-day, namely, approximately 3s. 6d. per ton mile. If civil aviation is to run on its own feet, without subsidy, although the first necessity is expansion of services so as to reduce overhead charges per passenger or per lb. of freight, yet, at the same time, there is ample scope for improvement in machines. To-day, the average covered aircraft carries between 15 and 17 lbs. for every horse-power installed, of which, at the outside, 4 to 5 lbs. per horse-power is the useful or paying load. The cruising speed

varies between 85 and 100 miles per hour. It should not be impossible within the next few years to increase the total carrying capacity for the same top speed to, say, 25 lbs. per horse-power, and obtain a useful load of 10 lbs. per horse-power. If this were done the cost per ton-mile would be reduced to 1s. 6d. for full load. With the London—Paris route, this means a cost of approximately £18 per ton, or say £1 10s. per passenger and 1¾d. per lb. of freight.

In this paper I have limited myself to a plain review of the traffic results and conditions obtaining in air transport at the present time.

The necessary basis for commercial air operations has been thoroughly tried out in these few experimental years and it needs only the necessary support to be forthcoming for the extensions of the routes to be opened and the great Imperial air route to the East to be started.

APPENDIX.

EXAMPLES OF FRENCH SUBSIDIES.

PAID PER TRIP ON PARIS—LONDON ROUTE.

(1) *Farman Goliath.*

Purchase subsidy.

State pays half cost of machine (without engines) and three-quarter cost of engines. Life of machine reckoned at 200 hours. Therefore, proportion per trip (2.6 hours)=1,460 frs.

Kilometric subsidy.

Fixed subsidy, 9.87 frs. (for Goliath machine) =3,520 frs.

Commercial profits subsidy.

Passengers ... 100%
Goods ... 100%
Newspapers... 100%
} of rate charged on London-Paris route.

Half-load. (1,670 lbs.)	7 passengers	2,100 frs.
	250 kgs. freight at, say, 2.5 frs. per kg. ...	625 ,,
		2,725 ,,
Full load. (3,050 lbs.)	12 passengers	3,600 ,,
	500 kgs. freight at, say, 2.5 frs. per kg. ...	1,250 ,,
		4,850 ,,

W/T bonus. 375 kms. at 25 cts.=93 frs.

Total. Half-load, 7,798 frs.=£310 at par.
Full load 11,923 frs.=£475 ,, ,,

(2) *Spad* 33 (*Limousine*).

Purchase subsidy.

State pays half-cost of machine (without engine) and three-quarter cost of engines. Life of machine reckoned as 200 hours. Therefore, proportion per trip (2.6 hours)=643 frs.

Kilometric subsidy.

Fixed subsidy, 4.86 frs.=1,822 frs.

Commercial profits subsidy.

Passengers
Freight
} 100% of rates charged London—Paris route.

Half-load.	2 passengers	600 frs.
	50 kgs. freight at, say, 2.50 frs. per kg. ...	125 ,,
		725 ,,
Full load.	5 passengers	1,500 frs.
	100 kg. freight at, say, 2.50 frs. per kg. ...	250 ,,
		1,750 ,,

Total. Half-load 3,190 frs.=£128 at par.
Full load 4,215 frs.=£168 ,, ,,